REMARKS

Claims 11-14, 16-19, and 21-29 are pending in this application, and claims 1-10, 15, and 20 are cancelled herein. Claims 11-13, and 16-19 have been amended, and claims 21-29 are added. In view of these amendments and remarks, Applicant respectfully requests reconsideration of the claims.

Claim 1-11 and 13-20 were rejected under 35 U.S.C. 102(e) or 35 U.S.C. 103(a) as being unpatentable over the U.S. Patent No 6,627,463 B1 to Sarfaty (hereinafter referred to as Sarfaty). Dependent claim 12 was rejected under 35 U.S.C. 103(a) as being unpatentable over Sarfaty in view of U.S. Patent No. 6,669,782 B1 to Thakur (hereinafter referred to as Thakur).

However, claims 1-10, 15, and 20 have been canceled and the remaining original claims have been amended. New independent claims 21 and 27, and dependent claims 22-26, 28 and 29 have been added.

The two new independent claims 21 and 27 now in the case include a combination of limitations no where even suggested much less taught by the references of record whether considered singly or in combination.

Although the Sarfaty patent discusses plasma nitriding, gate oxide, and light intensity levels at different wavelengths of light, etc, the methods taught for using this information are difficult to control and imprecise.

The inventor of the present invention has recognized that the correlation between components or materials concentrations and the peak intensity of different light wavelengths in the range of 290nm and 400nm varies. As an example only, the applicant has also determined that the correlation of peak intensity and the concentration of nitrogen in the plasma is stronger at

shorter optical wavelengths such as 307.7nm and 390nm. (See paragraph 29 of the specification).

Further, the applicant has also discovered that the OES Optical Emission Spectroscopy peak intensity is primarily determined by the plasma chamber parameters such as the electrical power and chamber pressure and chamber temperature, and does not appear to be a function of time. Therefore, the nitrogen dose is correlated or varies with the peak light intensity at selected wavelengths, which in turn varies with plasma chamber parameters such as temperature, electrical power, and pressure. This discovery and understanding has allowed the applicant to invent and develop a combination of new nitriding process steps that are more precise and reliable. Specifically, the correlation between the averaged (over time) OES peak intensity and the nitrogen concentration may be quantitatively defined for selected wavelengths of light during plasma nitration at various parameters of the nitration chosen for selected fixed periods of time. That is because, as mentioned above, OES peak intensity is generally not a function of time. However, the nitrogen (or selected component) concentration is a function of time.

The Sarfaty reference, on the other hand, teaches the step of monitoring or looking for any steady state of the intensity level (i.e. no more changes in the intensity) no matter at what intensity level the steady state occurs. Unfortunately, this steady state typically will not be the peak intensity level at the particular parameters (temperature, pressure, electrical power settings) of the chamber during a production run. This is different than the present invention, which requires a peak intensity level for a selected wavelength in light during testing and at known thicknesses of the feature and known settings for the parameters that control the plasma chamber operation.

More specifically, the claims require determining the peak intensity reached by selected wavelengths of light emitted from the plasma at a multiplicity of settings of at least one of the parameters that control the plasma generated in the chamber. In addition, the correlation between the peak intensity level and the concentration level of a selected component element or material in the semiconductor feature is also determined.

This data is then used to select a specific wavelength of light having a peak intensity level at known chamber controlling parameters such as electrical power, temperature, and/or pressure and for a specific feature thickness. The production run circuits, having the same thickness, are then subjected to the plasma process at these controlling parameters. Therefore, the plasma treatment can then be continued until the peak intensity is reached (i.e. stops increasing) without concern about the time taken for the process run. That is, this approach is not time dependent and the desired concentration level will not be exceeded even if the plasma process continues after the peak intensity level is reached. That is, the peak intensity level cannot go higher. Thus, the monitoring is simplified and less critical and the results more predictable and precise.

Therefore, it is respectfully submitted that the new independent claims do now clearly patentably define over all the references of record and are allowable.

Likewise, the dependent claims are allowable for depending from claims deemed allowable as well as for their own further limitations.

In view of the above, Applicant respectfully submits that the application is in condition for allowance and requests that the Examiner pass the case to issuance. If the Examiner should have any questions, Applicant requests that the Examiner contact Applicant's attorney at 972-732-1001 so that such issues may be resolved as expeditiously as possible. No fee is believed due in connection with this filing. However, should one be deemed due, the Commissioner is hereby authorized to charge the appropriate fees to Deposit Account No. 50-1065.

Respectfully submitted,

5 Oct 2004
Date

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